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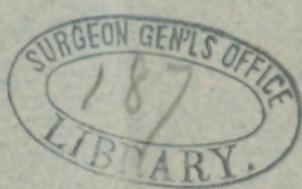
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ORTHOPEDIC SURGERY:
DEFORMITIES OF THE LOWER
EXTREMITIES.

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This paper will be confined to that particular kind of deformity usually termed Club Foot. I do this from the fact that the subdivision of Orthopedic Surgery is comprehensive, elaborate in details, and but imperfectly treated in the general works of surgery which fall into the hands of the general surgeon or practitioner.

One is struck with the force of the first part of this remark if he examine the special works on Orthopedics, and the truth of the latter part, if he compare these special treatises with the general works on Surgery, such as Gross, Erichson, etc.

The treatment of deformities is as old as medicine itself, for we can trace it back to the earliest periods of which we have any account. But the correct methods of treatment are of recent date, and have not yet fully taken hold of the profession.

This class of unfortunates has excited the pity and aroused the sympathy of the philanthropic and humane from time immemorial, and alas! in our latter day, the cupidity of the designing quack, who with his vain and boastful promises of cure, steals from whom God has stricken.

The deformed have always been peculiarly sensitive to their misfortunes, and regarded themselves with a blended feeling of loathing and pity. It would make a curious chapter in the history of morbid psychology to note the blighting, weird influences and unaccountable effects of club-foot upon the characters, acts and writings of distinguished men who have figured in the drama of public life, and moulded oftentimes important epochs in the world's history. Byron, who, in the language of his friend, Trelawney, after viewing his dead body—"was an Apollo in form and expression from the waist up, with the limbs of a sylvan satyr" is a fit subject for such contemplation. Who can say that Byron, with his shrunken limbs, halting gait, extreme morbid sensibility, intense melancholy, a disbeliever in manly honor, and a destroyer of womanly virtue, would not have given a different tone and coloring to his writings, had he been born with straight feet? There is a secret history here of silent but powerfully working influences of which he himself occasionally gave us glimpses.

We see these influences operating on the Duke of Gloucester in his soliloquy:

" I that am curtailed of this fair proportion,
Cheated of feature by dissembling nature,
Deformed, unfinished, sent before my time
Into this breathing world, scarce half made up,
And that so lamely and un'ashionable
That dogs bark at me as I halt by them;
Why, I, in this weak, piping time of peace,
Have no delight to pass away the time,
Unless to spy mine shadow in the sun
And despise on my own deformity;
And therefore, since I cannot prove a lover,
To entertain these fair, well-spoken days,
I am determined to prove a villain,
And hate the idle pleasures of these days.

But time forbids us pursuing further this interesting aspect of the subject, and remands us back to the more accustomed grooves of inquiry as to the varieties, cause, seat, and best methods of treatment of club-foot. The division into four varieties can not be improved upon, viz: varus (inverted), equinus (heel elevated), valgus (everted), calcaneal (phalanges elevated). The names are given in the order in which they most frequently occur. Pure varus is rarely seen. The cases, so-called, being an inversion of the foot with more or less elevation of the heel, and hence we have the name of equino-varus. The same thing happens with valgus, eversion of the foot with contracted sural muscles, giving rise to the name equino-valgus. There are several other sub-varieties, combinations of the original four divisions, which are easily recognized when seen, but seldom occur.

We have often remarked in looking at it, that the skeleton of the human foot is one of the most shapeless and unsightly objects imaginable, but when bound together by its ligaments, clothed with muscles and tendons, and enveloped with integument, and endowed with its wonderful and varied functions of support and movement, it becomes a thing of beauty and inimitable grace.

In a normal foot the flexors and extensors, the adductors and abductors are so harmoniously poised and balanced, that the extremity in a state of rest assumes an easy and natural position, and readily responds to the various movements of the twelve muscles connecting it with the leg.

It is the unbalancing of some of these twelve muscles, the disturbance of their constant and harmonious tension which gives rise to the great majority of the deformities under consideration.

Derangement of the muscular force acting irregularly and in the wrong direction upon the bones, distorts and misplaces them, until we have the disease developed into its most hideous and repulsive forms.

Thus in varus, there is loss of action in the muscles supplied by the peroneal nerve, these being the peronei and flexor longus digitorium muscles, leaving the tibial muscles and gastrocnemius to invert the anterior portion of the foot and tilt up the heel. The anterior and posterior tibial muscles, aided by the plantar muscles and fascia, continuing to contract without any antagonizing influence from the peronei, cause the arch of the foot to take an exaggerated curve, and twist the foot inwards at the medio-tarsal and tarso-phalangeal articulations, so that the patient walks first upon the outer margin, and finally

upon the dorsal surface of the foot. The foot taking an opposite direction in valgus, is drawn outwards by the peronei muscles, causing the person to walk upon the inner margin of the foot.

CAUSES.

Although the immediate cause of the deformities under consideration lies in the defective action of certain muscles, still we must look further, and in doing so, will find the trouble begins in the nerves supplying these muscles, and sometimes in the nerve centers themselves.

It is pretty generally agreed among modern pathologists, that in congenital, as well as most cases of acquired talipes, defective innervation resulting in motor-paralysis is the primary cause of all these deformities. The older view of Cruveilhier and his followers, that the position of the fetus in utero was the exciting cause, has but few, if any, adherents to-day.

Bauer says: "After mature deliberation I have come to the conclusion that the cause in congenital, as well as acquired club-foot, is pre-eminently defective innervation, and that there is truly no reason why derangements in the nervous system should not take place in the fetus as well as the newly-born child. In club-foot (varus) the tibial nerve is the bearer of the difficulty, as must be inferred from the experiments of Bonnet."

"The acquired instances of club-foot are comparatively rare, and they depend most unquestionably on impediments and lesions of the spinal cord. We can discriminate two forms of acquired varus. The active form is the less frequent, consisting in reflex action in both extensors and adductors. The extensors most usually preponderate, and we see therefore equino-varus and the passive form as a sequel of motor paralysis."

"The congenital forms," says Sayre, in his recent work on Club-foot, "are all due to some interference, general or local, with the normal innervation of the part. So much has been generally accepted, but the real nature of this nervous disturbance has been for the most part misunderstood." * * *

"What has been said above of the lesion in congenital talipes, is to a great extent true of the acquired form. Acquired talipes is very generally due to the various kinds of "infantile paralysis," which are the frequent sequelæ of scarlatina, diphtheria, dentition, and many other diseases in which blood-poisoning exists, and which are attended with great exhaustion."

Barwell, Prince, and other orthopedists hold the same opinions with little or no variation.

In what does this defective innervation consist? For just here, the right comprehension of this point, gives the key to the proper treatment, and also clears away the smoke of battle which has been waged between the tenotomists and non-tenotomists. Does the so-called defective innervation of the muscles result in spastic contraction, as contended for by some, or in the paralysis of the muscles by others? If we will but take the time to carefully examine a case of infantile club-foot, we will find there are certain muscles which have lost their power to contract through the natural stimulus of the will, in other words, their defective innervation has resulted in motor paralysis. They have ceased to antagonize the muscles of the opposite side, having lost not only their ability to contract in response to the will, or a stimulus from the spinal cord, but their natural tonicity, that normal tension which is so necessary for the harmonious

development of all muscular parts. The antagonizing muscles finding nothing to pull against, continue to shorten by their natural tonicity until they meet the proper resistance from the ligaments holding the bones together, or the bones themselves. There is no exaggerated or extraordinary force on the part of the muscles, it is only their normal quantum, but it produces an extraordinary result in the shape of a deformity, simply because their balancing muscles are *hors du combat* from defective innervation, just as much as if their tendons were severed. The symmetrical development and growth of the bones, muscles and nerves of the lower extremities, the unerring certainty and perfection with which the process advances and is accomplished, is one of the marvels in the study of life. Look at that cluster of embryonic cells! See them segment, now assume some rude form! Is it to be a dog, a cat, or a human being? From its present appearance who can tell? Upon what pattern is the work being done? Where is the artificer? Whence comes the skill and intelligence which guides the force acting upon those plastic cells, to push out nodules here and there which finally become extremities? In these extremities what varied materials and how harmoniously blended and interwoven? And yet the addition of structure upon structure and function upon function has mysteriously advanced under the law of development until the process is completed, the work is finished, the pattern is worked out, and the result a human foot, a most admirable and perfect piece of mechanism.

In this instance nature has turned out a perfect piece of work. We admire it, but how much do we know of the processes? Nothing! We only judge of it by the result. But sometimes nature spoils the job, the pattern is not followed, and the result is some one of the forms of club-foot. According to French statistics nature in working out her patterns, commits an error in one out of every three thousand French inhabitants. Why is there one failure to every three thousand perfect patterns? We must look to the physiologist for light. For until he can tell us more about the processes employed in the perfect patterns, how can we detect the hitch which results in a spoiled pattern? The causes of defective innervation are still a mystery, they result in paralysis, the latter in deformity.

The main point to be kept in mind by the orthopedist, is, that the principal cause of talipes is the paralysis of the muscles on the opposite side of the foot to which it is drawn. These weakened muscles being unable to continue the contest with their more vigorous antagonists, give way, and the foot is drawn to the well side. At this stage of the process, there is no disease of the muscles on the side to which the foot is drawn, they are simply performing their normal function; the disease is on the opposite side of the foot. In a case of varus, the peronei muscles are at fault. How unphilosophical, then, the almost universal injunction of general works on surgery to perform tenotomy; in other words, to cut the tendons of the well muscles to cure the disease of the weakened ones. Is it not more rational to antagonize the well muscles, giving them the healthy stimulus of a pull with elastic bands, and in the meantime address proper remedies, such as electricity, friction, exercise, etc., to the paralyzed muscles to restore their tone and vigorous vitality? We are all well aware of the universal physiological law, that when a muscle has been allowed to remain contracted for a variable length of time, important nutritive changes take place in its minute structure which disqualify it for immediate use as a muscle. After

such a change tenotomy becomes a valuable aid in treatment. But as the people are being awakened to the importance of bringing their deformed children early to the surgeon, these cases of permanent contraction are becoming less frequent, and will be of rare occurrence in the future.

SEAT OF TALIPES.

The generic name talipes would seem to indicate, as it really has done to a great extent in the minds of surgeons, that the seat of deformity existed solely at the ankle-joint, or what is now called the tibio-tarsal articulation. Barwell was the first to point out clearly the true seat of talipes, especially in varus and valgus, in his little book, "Club-foot without division of tendons."

In this he uses the term "medio-tarsal articulation" to designate the joint between the cuboid and os calcis on the outer side of the foot, and the astragalus and scaphoid on the inner side. He shows that it is at this joint the twist takes place inwards in varus and outwards in valgus, instead of at the ankle-joint. I have made dissections of the foot, removing all the structures except the ligaments, and at first was struck with the great mobility of the foot at this medio-tarsal articulation, and with the almost total absence of lateral motion between the astragalus and tibia. In fact Dr. Sayre, of New York, claims, in his recent work on club-foot, that there is no lateral motion whatever of the astragalus. That the internal maleolus formed by the tibia and the external maleolus formed by the fibula fit so closely, and are held so tightly by the external and internal lateral ligaments upon the lateral articular surfaces of the astragalus, as to prevent *any* lateral movements between the astragalus and tibia, and that whatever lateral movements appear to take place at the ankle-joint in the normal foot, are really movements at the medio-tarsal articulation, together with a sliding of the os-calcis upon the astragalus. Since making dissections of the foot with special reference to these points, I agree with Dr. Sayre, and think that he, next to Barwell, deserves the greatest credit for the light he has thrown upon the anatomy of the foot with reference to club-foot.

And yet Dr. Gross, of Philadelphia, in a letter to Dr. Sayre, "thanking him for his work, which, he states, is of great value to the profession," adds: "I shall continue to make lateral motion at my ankle-joint without rotating my hip or revolving the head of my fibula."

This is but another example of the tenacity with which some people hold on preconceived ideas. In fact I am constrained to say, after a careful examination of the section on club-foot by Dr. Gross in his last edition of surgery, that he does not come fully up to the advances recently made in this department of surgery, as to the causes or seat of the deformity under consideration. Speaking of the causes, he says: "The most plausible view, perhaps, is that the distortion is produced by a defect of nervous influence, leading to a permanent contraction of certain muscles with a corresponding retraction and incurvation of the bones into which these muscles are inserted. Vol. ii, p. 1044.

As we have already shown above, this is just the opposite to the expressed views of the best orthopedists of the present day, based upon the most laborious investigations of the anatomy and physiology of the normal foot, and also of the etiology, pathology and results of treatment of club-foot.

We do not believe that "a defect of nervous influence" leads first to contraction of certain muscles, but to a paralysis of the opposite muscles, and that

afterwards it is the normal contraction of the muscles which causes the foot to deviate from its proper shape.

Dr. Gross is very vague and indefinite as to the seat of varus and valgus. "The calcaneum, cuboid, scaphoid and astragalus," he says, "suffer more than the other bones, which, however, as well as those of the metatarsus and toes usually participate more or less, in the deformity." Vol. ii, page 1047.

How unsatisfactory when compared with the elaborations of Bauer, Prince, Barwell and Sayre upon these points.

We have the highest respect for Dr. Gross and the splendid work on surgery he has given the world. And although we could not expect him to give that fullness and detail on special subjects, such as club-foot, as is given by writers of special treatises, still we have a right to expect the latest views and most approved methods in these general works in the clearest and most concise form.

TREATMENT.

If the ground we have taken in the foregoing pages be correct, it will be easy to state the main principles of treatment. The object before us will be to tone up and reinvigorate nerves which have lost their excitability and conductivity, and at the same time re-awaken the irritability and contractility of the paralyzed muscles, not forgetting to draw out and unravel the contracted fibres of those muscles on the side to which the deformed foot is drawn. The discovery of Stromeyer in 1831 that tendons and muscles might be subcutaneously divided with impunity, gave a wonderful impetus to this department of surgery. Although cutting the tendons of contracted muscles seemed to cure the deformity, yet in time the trouble returned, and tenotomy, though received with great enthusiasm and practiced with high hopes, disappointed expectations, and lost finally in the confidence of the people and profession. Experience has assigned tenotomy its proper place, and pointed out its true value in those cases in which permanent contraction has taken place in the muscle, rendering it incapable of responding to the ordinary stimuli generally used. Tenotomy has been disadvantageous to the rapid development of orthopedic surgery, from the fact that surgeons have relied too exclusively upon this means to correct the deformity, and to the neglect of proper mechanical appliances. Tenotomy should only be used when other means have been sufficiently tried and failed. It looks brilliant and gives eclat to seize a knife, divide a tendon or two, and seem to straighten a contorted foot at one sitting. This is the temptation, and has its fascinations to the surgical mind. If we take the foot of a child with varus in the hand, we will find no difficulty by proper manipulation in making the foot assume the proper relation to the leg. And if our hands could so remain applied day and night for a certain length of time, a most admirable cure would be the result. The child would get well without abrasions, serious pressure or painful distortions. Bauer, Prince and Sayre, all admit that the human hand would make the most perfect apparatus, and that the most desirable instruments are those which approximate most nearly the actions of the hand. The more a club-foot is handled and freely manipulated, the more rapidly will its progress towards a cure be effected. And the treatment with the most approved mechanical contrivances is slow and imperfect without daily manipulation. Surgeons are too apt to think that when they have divided tendons, and applied

some form of apparatus, their work is done; it has only begun, and needs to be looked after daily with that earnest solicitude which does not fear work.

All orthopedic surgeons agree that some kind of mechanical apparatus is necessary in the treatment of club-foot, but the time has not yet arrived when we can all agree as to which is the best. Nearly every writer upon this subject has his own particular pattern, and is free to claim advantages for it he does not discover in others.

Dr. Bauer in his distrust of modern appliances, says, "There is no mechanical apparatus, however ingeniously constructed, which could be substituted for the hand in the treatment of talipes, with any approximate degree of efficiency." In the edition next to the last, Vol. ii, p. 1011, Dr. Gross does not hesitate to say, "It is perhaps not going too far to affirm that these topics (club-foot) are as well understood now as they ever will be." After reading the last edition of his surgery I do not find this sentence, and suppose his larger experience has lessened his enthusiasm in the apparatus then used. Dr. Prince is constrained to say, "It is believed that in the course of these pages a process will be explained, which is a pretty adequate substitute for the hand." Treatise on Orthopædics, p. 171.

This variety of opinion only proves that these distinguished authors and surgeons differ as to their methods, but arrive at the same result by different routes.

We are decidedly in favor of the extension method, or American plan, as it is sometimes called, in which elastic bands of rubber with adhesive strips, and sometimes a shoe are used. We do not discard the use of the tenotomy entirely, but keep it in the back-ground as much as possible. Any case of club-foot, which, when placed under the effects of ether, can be brought into its natural position by manipulation of the hand, ought to be relieved by the use of elastic bands and the shoe without tenotomy.

Division of the tendo Achillis is attended with less bad effects than any other tendon about the foot, and in cases of equinus, equino-varus and equino-valgus, where the foot cannot be brought into position by the hand, I divide the tendo Achillis. Tendons which run through long grooves with extensive synovial membranes, such as those of the peronei and posterior tibial muscles do not unite well after division, and are liable to destructive inflammation.

A case of ordinary talipes equino-varus may be successfully treated without any other appliances than the adhesive plaster, rubber bands and roller bandage, after Barwell's method. "The peculiarity of Barwell's plan consists in his method of attaching the proximal end of his tension apparatus, which is this: Starting with the idea of making the artificial tension, the exact complement of that of the partially paralyzed muscles, he aims to act as nearly as possible upon the same bones to which these muscles are attached (and in the same direction), by adhesive plaster fastenings, while the points from which the pull comes are the origins of these muscles." A piece of adhesive plaster is cut long enough for a piece of bent wire of sufficient strength to be fastened at one end, and the other to be passed under the sole of the foot and lapped across the dorsal surface. In varus the wired end of the plaster would be on the outer side of the foot for the attachment of the hook connected with the rubber band. Another piece of plaster is cut nearly twice the length of the leg between the ankle and knee-joint. A strip of tin corresponding in length to the distance

between ankle and knee-joint, one inch and a half to two inches in width, a little wider at the upper than lower end, is curved to adapt itself to the leg, and provided at the upper end and outer side with a wire loop or eyelet soldered on for the attachment of the other end of hook and chain connected with rubber band. In the supposed case of varus the plaster is placed up and down the leg, over the peronei muscles, with the sticking side next to the skin. The tin splint is placed on the plaster, but the latter being longest, the upper end is brought down over the tin, and a hole cut so that the wire loop may pass through; then the lower end of the plaster is treated likewise, and turned up over the lower end of the tin, and the whole permanently secured to the leg with a roller bandage. A short piece of medium-sized India-rubber tubing, having two small chains, one attached to either end, to be fastened to the wire of the foot-piece of plaster, and to the wire loop of the tin over the insertion of the peronei muscles completes the apparatus. By shortening the chains from time to time any amount of pull upon the foot is made which may be desirable. We readily see how these appliances can be transferred to the inside of the foot and used in the treatment of valgus, or to any of the other forms of talipes. The constant, steady pull day and night of the India-rubber finally overcomes the resistance of the contracted muscles, and they yield more kindly than they would to greater force applied through a shorter time. But this does not restore the paralyzed muscles. *They* must be stimulated daily by friction and the application of the interrupted electric current, so that they may be able in time to take the place of the India-rubber tubing and antagonize the formerly contracted muscles.

